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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/030,155	01/29/2002	Takashi Yasuo	020057	6389

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EXAMINER	
DOVE, TRACY MAE	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 06/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

AS

Office Action Summary	Application No.	Applicant(s)	
	10/030,155	YASUO ET AL.	
	Examiner	Art Unit	
	Tracy Dove	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 5-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 5-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the communication filed on 3/25/04. Applicant's arguments have been considered, but are not persuasive. Claims 1, 2 and 5-8 are pending. This Action is made FINAL, as necessitated by amendment.

Claims Analysis

Note that claim 6 recites "furnace black" or "acetylene black", which are both carbon black materials. See the attached definitions for "furnace black" and "acetylene black" as disclosed by Hawley's Condensed Chemical Dictionary.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 5 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Wood, III et al., US 6,350,539 B1.

Wood teaches a multi-layer gas distribution/diffusion structure for use with a membrane electrode assembly of a PEM fuel cell. The fuel cell includes a membrane electrode assembly (MEA) having an anode, ionomer membrane (electrolyte membrane), a cathode and catalyst layers (Figure 2). The layers of the diffusion structure have selected chemical and physical properties and together facilitate transport of reactant gas to the electrode (abstract). The diffusion structure includes a bulk layer with an absorption layer (first layer) on a surface of the

bulk layer facing the electrode structure and a desorption layer (second layer) on an opposite surface of the bulk layer facing away from the electrode structure (col. 2, lines 17-52). The multi-layer gas diffusion structure is particularly useful when applied to the outer surface of the cathode electrode (col. 4, lines 60-62). The diffusion structure has three or more distinct layers and is used in place of a conventional single-layer cathode diffusion structure. The three layers are distinguished by their respective hydrophobicity, pore-size distribution, mean and mode pore size, surface area, porosity, bulk density, chemical make-up or ingredients, and physical processing (col. 7, lines 13-23). The region adjacent to the electrode interface is the absorption layer 14 and is characterized by low hydrophobicity, low mean pore size, high surface area and high porosity. The region adjacent to the flow field plate is the desorption region 16 and is characterized by high hydrophobicity, high mean pore size, intermediate surface area and high porosity (col. 7, lines 31-41). The thickness of the layers will vary depending on the geometry of the PEM cell. The absorption layer is no less than 20 μm and no more than 150 μm and the desorption layer is no less than 40 μm and no more than 400 μm (col. 7, line 61-col. 8, line 2). Figure 2 shows an oxidizing gas (air) distributed along the cathode diffusion layer and a fuel gas (hydrogen) distributed along the anode diffusion layer. The absorption layer preferably has a thickness of 20-70 μm and a mean pore size between 0.1-1 μm. The desorption layer preferably has a thickness of 200-500 μm and a mean pore size between 50-150 μm (col. 16, lines 8-22). Base materials for the bulk layer are preferably paper, felt, mat or cloth made of carbon, graphite, or a carbon/graphite blend, which may also have a resin-type binding material for the individual fibers. The bulk layer is porous (col. 9, lines 30-41). Both the absorption layer and the desorption layer may comprise conductive carbon particles (col. 8, lines 18-26 and col. 10, lines

41-63). Table 1 discloses average specific surface area of the absorption layer (25-300 m^2/g) is greater than that of the desorption layer (0.05-1 m^2/g).

Thus the claims are anticipated.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wood, III et al., US 6,350,539 B1.

See discussion of Wood above with respect to claims 1, 2 and 5.

Wood does not explicitly state the conductive carbon particles of the absorption layer and/or desorption layer are furnace black (carbon black) and/or acetylene black (carbon black). Wood does not explicitly state the water retention capacity or water retention density of the diffusion structure.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because Wood teaches that the conductive particles of the absorption layer and/or desorption layer may be <u>any</u> graphite or any carbon material. One of skill would have found it obvious to use carbon black for the conductive carbon particles of the absorption and/or desorption layers of the diffusion structure because carbon black is a well known conductive carbon material used in fuel cells. Carbon black is a finely divided form of carbon. One of skill would have found it obvious to use a finely divided form of carbon (carbon

black in view of the teaching by Wood of "any carbon" material. Furthermore, the particle size of the conductive particles of the absorption layer and/or desorption layer is preferably 0.05-0.75 μm (col. 8, lines 26-28), which at least suggests a finely divided carbon material as the conductive particles of the layers.

Regarding the water retention capacity and density limitations, Wood teaches the water retention of the cathode diffusion medium, or suppression of the transport of the liquid phase across the diffusion medium/structure from the electrode interface to the gas channel interface, increases as the absolute value of the slope of contact angle versus time decreases. It is preferred that any given volume element of liquid water spends the least amount of time penetrating the surface of the diffusion structure as possible. The design challenge identified here is how to optimize the rate of absorption of water at the surface and minimize the retention time of any arbitrary volume element of water inside the diffusion medium. The features of the multi-layer diffusion structure achieve both objectives. Selection of materials, treatments, and processing technique which vary for layers within the diffusion structure produces different physical consequences depending on the location of a volume element of liquid water in the diffusion structure (col. 13, lines 58-col. 14, lines 14). One of skill would have been motivated to vary the absolute value of the slope of the contact angle (equation 4 at col. 13, lines 65) in order to vary the water retention properties of the diffusion structure. Specifically, water retention increases as the absolute value of the slope of the contact angle versus time decreases.

Response to Arguments

Applicant's arguments filed 3/25/04 have been fully considered but they are not persuasive.

Applicant discusses the terms "furnace black" and "acetylene black" recited by claim 6. Applicant states the office action of 1/29/04 mentions that the definition of these terms are not clear as these are both carbon black materials. This is incorrect. The Action did not reject under 35 U.S.C. 112, 2nd, or object to the terms "furnace black" and "acetylene black" found in claim 6. The Action points out "furnace black" and "acetylene black" are both carbon black materials.

Applicant notes a section of the instant specification that teaches Denka carbon black is used for the second layer and Ketjen Black is used for the first layer. However, claim 6 is not limited to this embodiment.

Applicant argues the Woods reference merely discloses a three-layered diffusion layer having porosity with pores of different diameters, but does not disclose any information on the specific surface areas of the conductive particles included in the gas diffusion layer. This is not correct. Table 1 discloses average specific surface areas for the absorption layer and the desorption layer. It is unclear how Applicant is attempting to distinguish the specific surface area of the layer from the specific surface area of the conductive particles. Specifically, the surface area of the layer is the same as the surface area of the conductive particles that may contact a reactant gas. If Applicant is indicating that the claimed surface areas are for the conductive particles before adhering the conductive particles to the base material, this limitation would be considered a product-by-process limitation, which would not be given patentable weight. Applicant has not distinguish the claimed invention over Woods, thus, the rejection is maintained.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tracy Dove whose telephone number is 571-272-1285. The examiner can normally be reached on Monday-Thursday (9:00-7:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

June 2, 2004

Patrick Ryan
Supervisory Patent Examiner
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